

**Andean beans with Resistance to Angular Leaf Spot and Virulence Diversity of
Phaeoisariopsis griseola in Southern and Eastern Africa**

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Introduction

Andean beans are the preferred class of beans in several Southern and Eastern African countries. In this region, angular leaf spot (ALS), caused by *Phaeoisariopsis griseola*, is the most widespread and economically important disease of the common bean. Production losses attributed to ALS in Southern Africa are estimated at 93,500 tons (2). Bean cultivars with genetic resistance are needed to effectively control ALS in this region. However, the success of these resistant cultivars can be marred by the virulence diversity of *P. griseola*. This pathogen has many races that often vary from one location or year to another. To address the ALS problem, a project was initiated in Malawi to find Andean beans with ALS resistance and to explore the virulence diversity of the ALS pathogen in Southern and Eastern Africa.

Results and Discussion

CAL 143, an Andean bean line well adapted and with high yield potential in Africa, was free of ALS under field conditions at Bunda, Malawi, during the crop season of 1992-93 and at Bembeke, Malawi, during 1993-94, 1994-95 and 1995-96 (Table 1). Two other Andean bean lines, AND 277 and AND 279, were also ALS resistant under field conditions at Bembeke. CAL 143 was also ALS resistant under field conditions in South Africa, Tanzania, and Zambia, but it was susceptible in Uganda. This susceptibility was attributed to the presence of a race of the ALS pathogen in Uganda that was not present in the other countries.

The virulence diversity of 15 isolates of *P. griseola* collected in Southern and Eastern African countries was characterized by inoculating each isolate on a set of 12 differential cultivars: six Andean and six Middle American. These isolates were characterized as nine different races of *P. griseola* (Table 2). Five of six isolates from Malawi and two of seven from Uganda, all obtained from large-seeded Andean beans, were characterized as four different Andean races. These races typically were compatible only or mostly with Andean differential cultivars (Table 2). The other five isolates from Uganda, and one each from Malawi, Rwanda, and the Democratic Republic of Congo, obtained from small or medium-seeded Middle American beans, were characterized as five different Middle American races. These races were compatible with both Andean and Middle American differential cultivars. When inoculated under greenhouse conditions with each of these isolates, CAL 143 was resistant to all but one of these isolates (Data not shown). CAL 143 was susceptible only to Ugandan isolate PG2UGD, obtained from a medium-seeded bean that was characterized as race 63-21 (Table 2). It is plausible that an isolate of race 63-21, present in Uganda but not in the other countries, rendered CAL 143 susceptible to ALS under field conditions in Uganda.

References

- van Schoonhoven, A. and M. A. Pastor-Corrales. 1987. Standard System for the Evaluation of Bean Germplasm. CIAT, Cali, Colombia.
- Wortmann, C. S., R. A. Kirkby, C. A. Eledu, and D. J. Allen. Atlas of common bean (*Phaseolus vulgaris* L.) production in Africa, 1998. CIAT, Cali, Colombia.

Table 1. Reaction of CAL 143 and other common bean cultivars to the angular leaf spot pathogen *Phaeoisariopsis griseola* under field conditions at Bembeke, Malawi, during the 1993 to 1996 crop seasons

Bean Cultivar	ALS Disease Score and Reaction Type ^a					
	Crop Seasons					
	1993-94	Reaction	1994-95	Reaction	1995-96	Reaction
1. Preliminary Bean Yield Trial (PBYT)						
<i>Andean</i>						
CAL 143	3	R	4	I	3	R
Nasaka	8	S	4	I	-	-
CAL 113	5	I	6	I	6	I
<i>Middle-American</i>						
A 286	2	R	-	-	-	-
EMP 308	-	-	-	-	3	-
2. Southern African Regional Bean Yield Trial (SARBYT)						
<i>Andean</i>						
CAL 143	2	R	2	R	3	R
Nasaka	7	S	-	-	-	-
Phalombe/Local	6	I	9	S	7	S
<i>Middle American</i>						
BAT 477	2	R	-	-	-	-
Nandi	-	-	4	I	4	I

^a ALS disease evaluations using a 1 to 9 rating scale, where 1 = No visible symptoms of the disease and 9 = very severe symptoms; (1) Schoonhoven and Pastor-Corrales, 1987. ALS reaction type: 1-3 = Resistant (R); 4-6 = Intermediate (I); 7-9 = Susceptible.

Table 2. Identification and virulence phenotype of 15 isolates of *Phaeoisariopsis griseola* (PG) obtained in common bean-producing countries in Africa. Isolates from large-seeded beans and Andean races are highlighted

Bean Differential Cultivars ^b and their Binary Number Value ^c															Virulence Phenotype (Race)
PG Isolate ID ^a	Origin Seed size	Andean					Middle American								
		A	B	C	D	E	F	G	H	I	J	K	L		
		1	2	4	8	16	32	1	2	4	8	16	32		
PG4MWI	L		b	c	d	e								30-0	
PG5MWI	L		b	c	d	e								30-0	
PG2MWI	L	a	b	c	d	e								31-0	
PG3MWI	L	a	b	c	d	e								31-0	
PG6MWI	L		b	c	d	e		g		i				30-5	
PG3UGD	L	a	b	c	d	e	f	g	h	i				63-7	
PG4UGD	L	a	b	c	d	e	f	g	h	i				63-7	
PG2UGD	M	a	b	c	d	e	f	g		i		k		63-21	
PG1UGD	S	a	b	c	d			g	h	i			l	15-39	
PG1MWI	S	a	b	c	d	e		g	h	i			l	31-39	
PG5UGD	M	a	b	c	d	e		g	h	i			l	31-39	
PG6UGD	S	a	b	c	d	e		g	h	i			l	31-39	
PG7UGD	S	a	b	c	d	e		g	h	i			l	31-39	
PG1RUA		a	b	c	d	e	f	g	h	i			l	63-39	
PG1ZAR		a	b	c				g	h	i		k	l	7-55	

^a Country of origin of isolate: MLW = Malawi, UGD = Uganda, RUA = Rwanda, ZAR = Democratic Republic of Congo (Formerly Zaire).

^b Andean differential cultivars: A = Don Timoteo, B = G11796, C = Bolón Bayo, D = Montcalm, E = Amendoin, F = G5686;

Middle American differential Cultivars: G = PAN 72, H = G 2858, I = Flor de Mayo, J = Mexico 54, K = BAT 332, L = Cornell 49242.

Lower case letters a to i indicate a compatible host pathogen interaction. ^c Binary values for the differential cultivars are: A and G = 1, B and H = 2, C and I = 4, D and J = 8, E and K = 16, and F and L = 32. The sum of the values of the susceptible cultivars will give the binary number of that specific race. A hyphen is used to separate the sum of the Andean and Middle American cultivars; e.g., Race 30-5 = virulent on Andean cultivars B, C, D, and E and on Middle American Cultivars G and I.